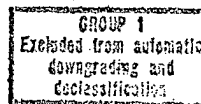


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DEVELOPMENT OBJECTIVE
A STUDY OF STORAGE & RETRIEVAL OF DIGITIZED
RECONNAISSANCE IMAGERY

- 1.0 PURPOSE. The objective of this study is analyze various methods and systems for storing and retrieving current and past imagery which is supplied initially in digital form (magnetic tape).
- 2.0 SCOPE. The study will include: a technical review & comparison of all the storage media which are compatible with sponsor requirements; a cost/effectiveness trade-off study of optional systems; analysis of the technical limitations of each; and recommendations for a particular system along with the rationale for its choice. The storage & retrieval systems to be studied must have characteristics which make them capable of supplying the imagery to a photo interpreter display in real time. (The display system itself is being investigated under a separate study and is not a subject of this storage & retrieval study. If required, display parameters can be discussed with the technical representative.)
- 3.0 APPLICABLE REFERENCE. The contractor is referred to the following report: "Analysis of Display Technology", Government Contract [redacted] 25X1
[redacted] (completed November 1970). The contractor will find 25X1
in this report up-to-date information on display technology, a general (though very limited) review of storage systems' capabilities and, most important, a list of manufacturers of storage and retrieval systems which form a nucleus of some of the best technology currently available. A microfiche copy of the report is included in the RFP package.
- 4.0 STATEMENT OF PROBLEM. Future reconnaissance systems may transmit imagery electromagnetically. In such a case the signals received would be processed into a digitized data stream which initially, at least, must be stored. There are several options available to the sponsor as to the best method of utilizing this digital data. For the purpose of this Development Objective, the option to be considered is the display of the digital data to a photointerpreter. The types of digital displays to be considered are outlined under the requirements section of the Development Objective. The contractor's responsibility will be to analyze the compatibility of current and future storage and retrieval systems with the sponsor's requirements for storing and displaying digitized imagery. The sponsor's requirements will be outlined in quantitative terms. Problem areas are to be identified. Technical options and/or solutions are to be recommended along with an estimate of the costs of the technical effort required to develop the system.

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5.0 REQUIREMENTS.

- 5.1 Storage Requirements. The sponsor's effort with respect to the storage of digitized imagery can be separated into three levels of requirements.
- 5.1.1 Buffer Storage. This stage must provide the capacity for efficiently storing at least 400 images. Each image could contain from a minimum of 3.24×10^9 bits to a maximum of 4.21×10^9 bits thereby requiring a total storage capacity of approximately 10^{12} bits. The maximum time these images would have to remain in storage would range from one to two days.
- 5.1.2 Intermediate Storage. This stage must have the capability of storing at least 2000 images. Based on the same number of bits for each image as stated in section 5.1.1, this would require a total capacity of from 6.48×10^{12} bits to 8.42×10^{12} bits. It is anticipated that these images would be expected to remain in storage anywhere from 6 months to 1 year.
- 5.1.3 Permanent Storage. Ideally, this level should provide the capacity of about 60,000 images. This would require from 1.94×10^{14} bits to 2.52×10^{14} bits storage capability. The images would be expected to stay in storage a year or more.
- 5.2 Retrieval Requirements. Retrieval of the imagery from storage will be categorized into "on-line" and "off-line" capabilities. An on-line capability is defined as immediate access to an image by a photointerpreter through a display device. Conversely, an image stored off-line would require the additional step of being put on-line (into active storage) before a photointerpreter could view it. With respect to the three levels of storage required, the buffer stage and the intermediate stage must be on-line; the permanent storage can be off-line.
- 5.2.1 Display Devices. The selection of the specific display device used to present the stored data as an image to the photointerpreter has not as yet been determined. The primary display devices under consideration 1) cathode ray tubes, 2) light valves, and 3) laser scanners. Of the three display systems, the sponsor feels that the cathode ray tube presently has more resolution capability than any of the other devices and, therefore, is pursuing a contractual effort to determine if a CRT can be used as a practical display tool in an exploitation environment. For these reasons the contractor should first consider interfaces with a CRT display. However, he is also encouraged to consider the interfaces with other types of displays, if he can demonstrate the rationale for his recommendation.

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5.2.2 Data Rate. Storage for display generation has two major criteria: 1) retrieval rates which are defined as the rate (megabits per second) for bringing the stored data to the display device, and 2) acquisition rates which are defined as the rates the information could be received from a data source and placed into storage. The buffer and the intermediate stages of storage will place definitive restrictions upon the retrieval and acquisition rates because of their on-line function, but permanent storage may or may not be affected depending upon the nature of its design implementation.

5.2.2.1 Buffer Storage Rates. The buffer storage will receive information from separate data streams, each stream of information containing somewhere between 81 megabits/sec and 110 megabits/sec. Each individual data stream represents one-fourth of a total image format. Because of this four channel input to the buffer stage, the contractor must consider reassembly, i.e., electronically putting the image 'back together' before it is displayed to the photointerpreter. This is a major requirement for the buffer stage. The second requirement for this stage is that it input the stored digital data to remote display devices upon command from individual photointerpretation stations. The retrieval rates necessary to refresh the display device and/or the interface system between the buffer stage and the display device is an inherent part of the problem the contractor will analyze in order to derive and present technical and cost trade-offs. The retrieval rate will be based upon this overall analysis.

5.2.2.2 Intermediate Storage Rates. The acquisition rate of the intermediate stage must be fully compatible with that of the buffer stage. The primary purpose of this compatibility is to allow a photointerpreter to transmit an image from the buffer stage to the intermediate stage if desired. A critical requirement for transferring images from one stage of storage to another is that it be accomplished within milliseconds if possible. The intermediate stage of storage will also be required to input its stored data to a display device. The same parameters governing the buffer stage retrieval rates will apply.

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5.2.2.3 Permanent Stage. The permanent stage must have a compatible link with the intermediate stage to allow the ready transfer of images. There is no requirement for the permanent stage to drive a display device.

5.2.2.4 Photointerpreter Stations. An important requirement for the contractor to consider in his recommendation for a system is that it will serve about six to ten stations operating simultaneously each using two displays. One display for reviewing all new "incoming" imagery, and the other for comparing "Past" imagery covering the same scene. In addition, the system must provide each photointerpreter with the capability to transmit images automatically from the buffer to the intermediate stage and ultimately into permanent storage. A purge system at each level for deleting undesirable imagery must also be incorporated into the system.

6.0 The information presented in section 4.0 is a broad outline of the sponsor's requirements with regards to storage of digitized imagery. Within the boundaries of these requirements, the contractor is expected to propose a technically feasible system, or systems, capable of implementing the tasks as outlined, or to propose those developmental efforts that could achieve the desired result. The contractor is encouraged to recommend new ideas, as alternatives, even though they may diverge from the system concept outlined in this Development Objective. Specific categories of information sought by the sponsor within the context of this effort are as follows:

6.1 Mass Storage. A complete review of current capabilities and a detailed description of the technology and state-of-the-art involved for each mass storage system considered in this effort. Parameters such as cost per bit, size, acquisition and retrieval rates, availability, access rates, etc. must be discussed in quantitative terms for each system, and the most feasible systems compared.

6.2 Displays. The problems of interface between the stored digitized imagery and various types of display is to be analyzed and a feasible system recommended. The contractor will limit his effort strictly to an equipment oriented approach and not become involved in a subjective analysis of optimum viewing conditions on a CRT. Areas of concern to the sponsor are refresh rate capabilities, compatibility of

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retrieval rates with contemporary CRT scanning rates, and an overall assessment of the limitations of current CRT technology in handling the large volume of bits represented by one digitized image. Recommendations for related developmental efforts or new ideas are encouraged.

6.3 Accuracy. Quantitative estimates of the errors introduced in storing information and in retrieving it must be included for each system described.

6.4 Length of Storage. Considerations directly affecting the time required to store the digitized image are to be addressed. Of concern to the sponsor are requirements such as: controlled room environments, non-interrupted electrical service, special tools or equipments, etc., that are pertinent to each mass storage system included for consideration in this effort. Each item should be costed.

7.0 ITEMS REQUIRED. The following deliverable items are required by the Government under this program.

7.1 Three (3) copies of monthly progress reports in accordance with DB-1001 (attached).

7.2 Five (5) copies of the final report.

8.0 GENERAL.

8.1 Administration. The Government will retain overall control of this program. Written approval from the contracting officer must be obtained before any changes in objectives, costs, or priorities are affected.

8.2 Draft Report. A draft copy of the final report will be submitted to the technical representative for review and approval at least one month prior to expected date of publication.

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